Modern Concepts of Cardiovascular Disease

Published monthly by the AMERICAN HEART ASSOCIATION

44 EAST 23RD STREET, NEW YORK 10, N. Y.

Editor
BENEDICT F. MASSELL, M.D., Boston

Associate Editor
GORDON S. MYERS, M.D., Boston

Copyright 1955 by American Heart Association

Vol. XXIV **MAY, 1955** **No. 5**

ARTERIAL GRAFTS IN THE TREATMENT OF ARTERIAL DEGENERATIVE DISEASE*

As long as 50 years ago arterial grafting had been carefully worked out and described by Carrel. Thirty years ago LeRiche recognized that many arteriosclerotic obstructions in extremity vessels were segmental, discrete, and ideally suited for treatment by blood vessel graft. At the present time surgical replacement of defective arteries by artery grafts is a procedure of proved worth. Although such surgery has but recently emerged from the experimental phase, most medical centers now have artery banks and other necessary facilities.

It is the purpose of this article to review arterial grafting as it is applied to the arteriosclerotic lesion and to describe some of the commonly encountered conditions which are amenable to this surgical procedure.

ARTERIOSCLEROTIC OCCLUSIVE DISEASE

Arterial occlusive disease of the lower extremities is recognized by the signs and symptoms of ischemia that it produces. Major degrees of ischemia produce frank gangrene, but lesser degrees may be missed or confused with other diseases. Thus, the "pulled calf muscle", the "ingrown toe nail", or the "chronic foot strain", all may be symptoms of ischemia. This should be considered when dealing with any lower extremity complaint, especially in the older age group.

Intermittent claudication, that is pain appearing in insufficiently vascularized muscles on exercise, is a prominent symptom of arterial occlusive disease. The location of an arterial obstruction can often be determined by eliciting the location of the claudication pain. Thus, an iliac artery obstruction causes pain in the thigh and leg while tibial artery obstruction may cause pain in the intrinsic foot muscles only. Intermittent claudication may be present with very mild degrees of circulatory impairment. In more severe degrees of ischemia, pain in the foot may appear at rest. This pain is experienced especially at night and paradoxically is relieved by activity.

Arterial occlusion will cause disappearance of palpable pulses distal to the point of occlusion, so palpation of pulses in the foot, the popliteal space, and the groin will aid in localizing the point of obstruction. Other signs of ischemia to be looked for are coldness, cyanosis, atrophy of subcutaneous tissue and skin, delayed venous filling or rubor on dependency, blanching on elevation, and unusual delay in the healing of minor injuries to the feet and legs.

Where it can be accomplished, arterial grafting will result in improvement in circulation far superior to that obtainable from any other therapy. However, conservative measures and other surgical procedures such as sympathectomy are as important as ever for the cases not suitable for grafting and as ancillary treatment to grafting.

In order that arterial grafting be feasible, the obstructed segment of artery must be above the level of the popliteal artery bifurcation, and the popliteal artery itself must be open. If the obstruction is not discrete and segmental in nature and extends to involve all the distal major arterial tree, grafting will be impossible since there is no place to insert the distal end of the graft. Vessels beyond the popliteal artery are too small to allow an anastomosis of a graft by current techniques.

Although a fair estimate of the extent of arterial occlusion may be made on physical examination, an arteriogram must be made for final evaluation. Disease in the abdominal aorta and iliac arteries is studied by translumbar aortography. Here x-rays are taken following injection of 70% Diodrast® or Urokon® into the upper abdominal aorta through a long needle introduced percutaneously under local or light general anesthesia. The thigh and leg vessels are demonstrated by femoral arteriography. This is a simpler procedure involving the injection of 35% Diodrast® or Urokon® through a needle placed percutaneously into the femoral artery at the groin under local anesthesia.

Obstruction may be limited to the smaller most distal vessels, especially in diabetic patients, but the vast majority of patients will show obstruction in the femoral artery or higher, and it is this group of patients which we will consider.

Major arterial obstruction occurs in three characteristic locations, the superficial femoral artery

* From the Department of Surgery, Massachusetts General Hospital.

where the vessel is crossed by the insertion of the adductor magnus muscle in the lower thigh, the common iliac artery at its bifurcation, and the aortic bifurcation. Each presents a somewhat different picture and will be considered separately.

Femoral Artery Occlusion

In the majority of cases the obstructing lesion lies in the superficial femoral artery. It will range in extent from a blockage less than a cm. in length to occlusion of the entire superficial femoral and popliteal arteries. As long as the popliteal artery remains open and of fair caliber, it is possible to bridge the obstruction with a graft.

Where the block is limited and collateral circulation is good, the only symptom will be intermittent claudication in the calf. Where collateral circulation is poor or where there is associated disease in the arteries of the lower leg, more severe ischemia will result. Almost all patients with intermittent claudication will prove to have segmental operable lesions on arteriography. Only about one quarter of the patients with severe ischemia and gangrene will prove to have an operable lesion. Most patients with gangrene have occlusion extending through the popliteal artery. However, all patients considered for major amputation should be screened to locate the operable cases since restoration of arterial continuity by a graft will save the extremity. It is possible to select cases so that a graft will be successful in 80 to 90%.

Iliac Obstruction

Iliac occlusions are usually well compensated and seldom produce gangrene in the absence of disease in the arteries distal to the occlusion. The presenting complaint in these patients is usually intermittent claudication. Iliac occlusions are clinically recognized by the distribution of the pain of the intermittent claudication which is felt in the thigh and buttock as well as the calf and by a weak or absent femoral pulse. In general, iliac obstructions are easier to deal with surgically since the vessels are of larger caliber and therefore the percentage of successful grafts will be greater. Where there is associated obstruction of more distal arteries and severe ischemia of the foot, circulation will be improved by correcting the iliac block since an increased pressure and perfusion of distal collateral vessels will result.

Aortic Occlusion

Arteriosclerotic occlusion of the aortic bifurcation, the LeRiche syndrome, is most often seen in men. It may occur in patients in their forties with very little arteriosclerosis elsewhere. It produces bilateral intermittent claudication with pain in calf, thigh, buttock, and back and also may make the patient impotent. Since the occlusion is gradual and progressive and accompanied by an increase in collateral circulation, the entire abdominal aorta and iliac arteries from the renal arteries to the common femoral artery may be occluded without gangrene of the legs. Where good vessels are demonstrated below the block on arteriography, the replacement of the occluded aorta and iliac arteries by an arterial graft can be performed with a reasonably small risk and results in complete rehabilitation of the patient.

Results of Treatment

Where it has been possible to restore continuity in such segmentally obstructed arteriosclerotic vessels, the relief of ischemia has been dramatic. Symptoms of intermittent claudication are completely relieved. Pain disappears overnight. Early gangrene and ischemic lesions rapidly heal. The incidence of successful operation in the group of patients with mild ischemia and intermittent claudication has been well over 90%, and failure has rarely made the circulation worse. Patients with gangrene and more advanced arterial disease have less chance of successful operation as one would expect. The surgery itself has proved to have a low mortality and morbidity and can be compared with other accepted elective surgical procedures in this regard. The mortality at the Massachusetts General Hospital has been less than 3%.

Indications for Surgery

For consideration of the indications for arterial graft, patients are divided into two groups: the first consisting of those with intermittent claudication only as a complaint, and the second consisting of those with serious ischemia or ischemic lesions which threaten major amputation. Almost all patients with intermittent claudication only will have a lesion which is technically feasible to by-pass with a graft. This, however, does not mean that all these patients should be operated on. Patients should be given an opportunity to develop their own collateral circulation. Not infrequently, particularly in youthful patients, symptoms of ischemia will entirely disappear between four to six months following occlusion. Patients whose exercise tolerance is already limited by angina pectoris or who can very easily and comfortably adjust to their intermittent claudication would not ordinarily be considered suitable candidates. The ideal candidate is a good-risk patient disabled by intermittent claudication who has had a trial at conservative treatment.

Indications are considerably more liberal in the group of patients threatened with major amputation. Since such patients are already committed to major surgery, poor risks are acceptable. Only about one quarter of these patients will have operable lesions, but the result of successful grafts in this group are so gratifying that

all patients should be screened by arteriogram so as not to deny any the chance of having their extremities saved.

ARTERIOSCLEROTIC ANEURYSMS

An arteriosclerotic aneurysm is a ballooning of an artery occurring in a region weakened by arteriosclerosis. Such aneurysms are most familiar in the abdominal aorta and popliteal artery. They may, however, occur in any artery. They may be classified according to their behavior into central aneurysms and peripheral aneurysms. Central aneurysms, occurring in the abdominal or thoracic cavities, are very dangerous lesions because of the extreme likelihood of rupture and exanguination. Peripheral aneurysms, on the other hand, rarely rupture and usually get the patient into trouble by thrombosing and thus interrupting the circulation to the distal part and causing gangrene.

It is generally recognized that the best available therapy for such lesions is their surgical removal and replacement by an arterial graft.

Peripheral Aneurysms

The peripheral aneurysm is typified by the popliteal aneurysm. The next most common location is in the femoral artery at the groin. These aneurysms are readily diagnosed by the presence of a pulsatile mass. The patient frequently presents with this complaint but may be unaware of it. Such lesions are a serious threat to the patient's limb and demand active therapy. Linton found a limb mortality of 77% in a series of 22 untreated popliteal aneurysms. Resection and graft of an aneurysm in an extremity is the easiest of vessel grafting operations and should be immediately and seriously considered when peripheral aneurysms are encountered.

Central Aneurysms

Abdominal aortic aneurysms are the most common of this group, and discussion will be based on them. Iliac aneurysms can be considered with them. Arteriosclerotic thoracic aortic aneurysms do occur, but their therapy is still in an experimental phase and cannot be considered here.

The diagnosis of an arteriosclerotic abdominal aneurysm is suspected on the palpation of a wide expansile epigastric mass. Aneurysms can be differentiated from prominent, normal aortas by their greater width. Also, patients with aneurysms usually have very prominent peripheral pulses. The diagnosis may be unquestionable on physical examination or may require confirmation from abdominal plane film or aortogram.

The lesion may be silent or may produce symptoms. Symptoms are inconstant and variable but may include back pain, throbbing pain referred to the aneurysm and relieved by pressure, and referred pain to the left thigh.

The prognosis in an untreated aneurysm is poor. Seventy per cent of these patients will die within three years, the vast majority from rupture of their aneurysms. The appearance of symptoms or an increase in size in an aneurysm is a danger sign.

Excision and graft of these aneurysms can be be performed with a mortality of less than 10% in good-risk patients. The mortality will, of course, increase with the age and decrepitude of the patient, and this should temper one's judgment. Operative indications may be defined as follows: Patients below 70 in otherwise good health should unquestionably have resection and graft of their aneurysm as soon as the diagnosis is made. Elderly or poor-risk patients should be followed while their aneurysms are silent but, with the appearance of symptoms, operation should be very seriously considered since the prognosis is so poor in untreated patients. Occasional patients are rescued by emergency operation after rupture of their aneurysm, but these are rare. The proper time to consider surgery is before such a disaster occurs.

ROBERT S. SHAW
Harvard Medical School
Boston, Mass.

The opinions and conclusions expressed herein are those of the author and do not necessarily represent the official views of the Scientific Council of the American Heart Association.

Modern Concepts of Cardiovascular Disease

A BOUND VOLUME OF THREE YEARS, 1952 THRU 1954

Now available in a handsome green Buckram cover with gold impressed title are the past thirty-six issues of the useful and informative MODERN CONCEPTS OF CARDIOVASCULAR DISEASE. The bound volume, indexed as to author and subject, provides a handy reference source for the cardiovascular topics presented from January 1952 to December 1954.

Order now to obtain this attractive and informative volume.

Price $3.00

THE ANNUAL MEETING
and
28th ANNUAL SCIENTIFIC SESSIONS
of
THE AMERICAN HEART ASSOCIATION
HEADQUARTERS: THE JUNG HOTEL
New Orleans, Louisiana

Meeting Schedule

Saturday, October 22nd	28th Annual Scientific Sessions
Sunday, October 23rd	28th Annual Scientific Sessions First Annual Program of Council on Community Service and Education
Monday, October 24th	28th Annual Scientific Sessions Joint Program—Council on Community Service & Education and Council on Rheumatic Fever and Congenital Heart Disease
Tuesday, October 25th	A.H.A. Assembly Panel Meetings
Wednesday, October 26th	Annual Meeting of A.H.A. Assembly—elections—panel reports Annual Meeting Staff Conference of Heart Associations

Social Functions

Monday, October 24th	A.H.A. Annual Dinner Dance—presentation of Gold Heart Awards
Tuesday, October 25th	A.H.A. Assembly Luncheon

PAPERS FOR THE SCIENTIFIC SESSIONS

All those wishing to present papers at the 28th Scientific Sessions of the American Heart Association must submit abstracts for review by the Program Committee. Abstracts shall not be more than *300 words* and must be submitted in duplicate before *July 1, 1955*, to the Medical Director, American Heart Association, 44 East 23rd Street, New York 10, New York. Abstracts should contain in summary form the results obtained and conclusions reached — *not* a statement that these will be presented at the meeting.

NOTES

NOTES